THE DENTAL PRACTITIONER

AND DENTAL RECORD

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THE DENTAL PRACTITIONER
AND DENTAL RECORD

Vol. VII, *No.* 7 — *March*, 1957

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THE DENTAL PRACTITIONER
AND DENTAL RECORD

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EDITORIAL

HOW DO YOU READ?

One of the main props of modern society is based on the fact that the vast majority of people are able to read. The Education Act of 1871, proclaiming compulsory education and the learning of the three R's, was the inevitable result of industrialization—indeed an essential if the nation were to progress. Illiterates to-day can all too easily find themselves in trouble, for the Welfare State has brought in its wake a host of forms and notices that have to be not only read but understood, as well as innumerable stamps that have to be licked on the right side. The fact of literacy is a sign of a civilized culture, but this very fact has brought in its train all sorts of uncultural side-effects. The good is accompanied by the bad in all things that can be read as well as heard. The novel, the press, the magazine, the cinema, radio and television, all have their extremes. The good and the bad are poured out 24 hours a day. The letter-box overflows with printed matter for every conceivable scheme to save time and to spend money. It is all there for our perusal, and it is not altogether surprising that we tend to suffer from verbal indigestion. The professional man by his education and training owes his status to the fact that above all he should be able to discriminate. He can read, but he can also reason. He should be able to pick from the morass and choose between the light and the dark. It is essential for the well-being of our patients and the status of the profession that we should be constantly aware of the pitfalls of the written word. We are a profession, not a trade, and perform a better service than merely selling fillings and dentures to our patients. One of our prime duties, like that of all members of the Health Service, is to give advice freely and honestly to our patients. This is only possible if we have read critically and assessed wisely beforehand. It is not for us to join the mêlée or to run with the crowd. We should know the direction in which we are travelling, and be able to keep a steady course towards our ideals both for the profession and our patients. We must read and listen, but not necessarily always accept, if we ourselves are to progress into an enlightened age.

OBSERVATIONS ON THE BEHAVIOUR OF FULL LOWER DENTURES

AN X-RAY CINEMATOGRAPHIC STUDY, WITH SPECIAL REFERENCE TO THE PERSPEX TRAY IMPRESSION METHOD*

By **G. M. ARDRAN**, M.D., D.M.R., **F. H. KEMP**, F.R.C.P., F.F.R., and **F. R. MUNZ**, D.M.D.

EVERY dental surgeon is aware of difficulties in making and fitting full lower dentures which are satisfactory functionally and cosmetically. If the dentures are to remain in place when the jaw and tongue move it is essential that muscular movements should not interfere with them. Munz (1954) has described a method for making dentures in which the main difficulties have been overcome. The use of transparent perspex enables the dentist to construct a tray which takes account of variations in the form of the floor of the mouth during movements of the tongue and lower jaw and of the attachments of the mucous membrane to the alveolus on the labial and buccal sides; though the different parts of the mucous membrane have different degrees of resilience the tray is adapted by grinding to fit evenly. A denture can then be constructed which will conform to these contours without causing pressure deformities and which will be kept in place by surface tension. It was

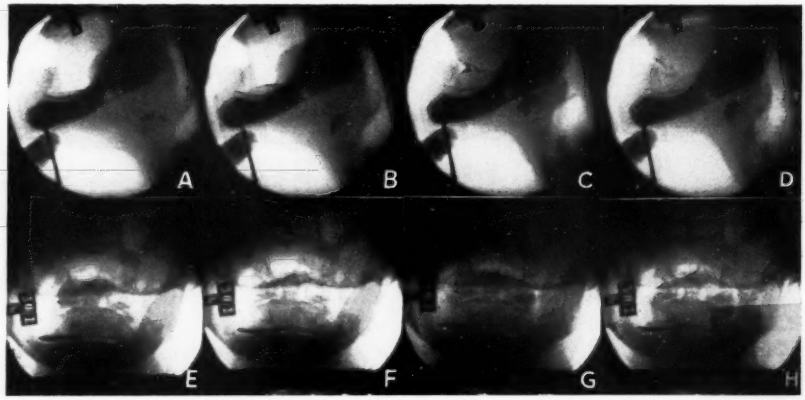

Fig. 1.—*Case* 8, *Table II.* Without dentures, showing the movements of the floor of the mouth on protruding the tongue. A, E, *Mouth closed.* Barium in the floor of the mouth and coating the sublingual folds; B, C, F, G, Tongue moving forwards with elevation of the sublingual folds; D, H, Tongue protruded.

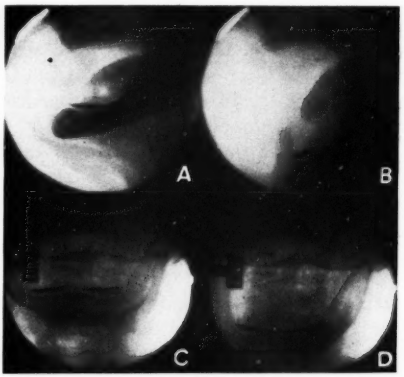

Fig. 2.—*Case* 8, *Table II.* Showing the movements of the floor of the mouth with the mouth closed and open. A, C, *Mouth closed.* A pool of barium in the floor of the mouth. Sublingual folds outlined with barium; B, D, *Mouth open.* Note the alteration in the appearance of the sublingual folds.

* Based on a communication and film demonstration given to the Continental Dental Society in London, April, 1956.

claimed that the technique was easy to learn and that dentures made by this method remained in position during movements of the jaws and tongue during speech and mastication; resorption of bone should be minimized as the tissues are exposed to even pressure.

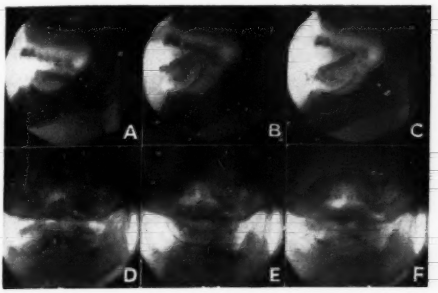

Fig. 3.—A hospital patient, who made no complaint about his dentures, showing gross movement on protruding the tongue.

The present paper describes cineradiographic investigations into the range of movement of full dentures fitted by this method.

MATERIALS AND METHODS

Two groups of patients were selected. The first group consisted of 10 patients from the Radcliffe Infirmary, Oxford, each of whom had full dentures fitted by an unknown dentist not more than 5 years previously and who made no complaint about their fit; they had no other abnormality or disease affecting the mouth or facial region. The second group comprised 10 patients who had dentures made by the perspex impression method fitted by one of us (F. R. M.).

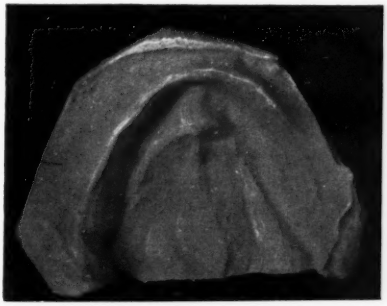

Fig. 4.—Alginate impression of the floor of the mouth of the patient illustrated in *Fig.* 3.

Table I.—Hospital Patients

Case No.	Age of Dentures	Movements of the Dentures			Comments
		Mouth Open and Shut	Tongue Protrusion	Chewing	
1	3 yr.	0·25 cm.	1 cm.	0·25 cm.	—
2	5 yr.	Nil	1 cm.	>0·25 cm.	—
3	3 yr.	Nil	0·25 cm.	<0·25 cm.	—
4	$4\frac{3}{4}$ yr.	0·25 cm.	0·5 cm.	0·5 cm.	—
5	2 yr.	0·25 cm.	1 cm.	1 cm.	—
6	5 yr.	Nil	>1 cm.	Nil	—
7	1 yr.	Nil	Nil	<0·25 cm.	—
8	1 yr.	Nil	<0·25 cm.	>0·25 cm.	—
9	4 yr.	1 cm.	1 cm.	0·5–1 cm.	—
10	4 yr.	Nil	0·5 cm.	0·25 cm.	—

Since the dentures were made of plastics which are not opaque to X rays, a thin malleable tin wire was temporarily fixed to the inner surface of the lingual flange of the left

half of the lower denture with self-polymerizing resin or wax.

Cineradiographic films (25 frames per second) were taken of the region of the mouth in antero-posterior and lateral projections (Ardran and Kemp, 1955). The patients were examined with and without dentures while opening and closing the mouth, protruding the tongue forwards to right and to left, and during mastication. Immediately before each exposure 0·5 to 1 ml. of fluid barium suspension was placed under the tongue to outline the sublingual space with an opaque medium.

In different subjects, various types of radio-opaque markers were used to determine the height of the epithelial crest above the level of the mandibular ridge and to show the relationship of these structures to the alveolar sulcus on the denture.

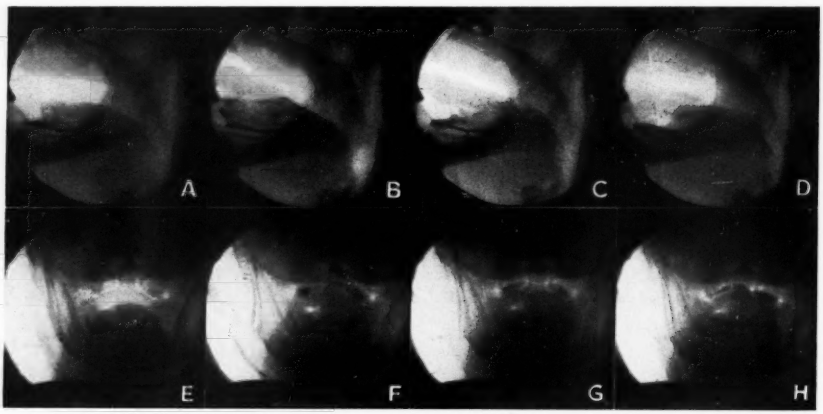

Fig. 5.—*Case* 9, *Table II.* With plastic dentures. Barium in the floor of the mouth. Tin wire marker fixed to the left lingual flange. Series showing various stages of protrusion of the tongue. The barium shows the change in the floor of the mouth but the tin wire does not move.

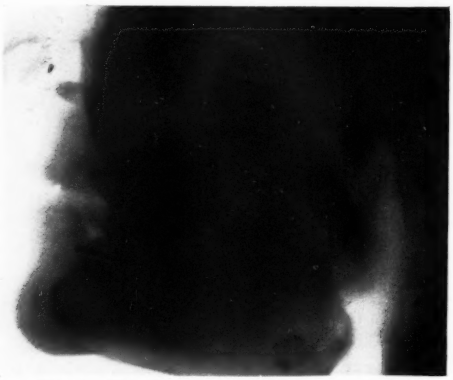

Fig. 6.—The patient illustrated in *Fig.* 5. Thin malleable tin wire applied to the floor of the left alveolar sulcus of the denture, demonstrating the relationship of the floor of the sulcus to the bony crest of the mandibular ridge.

RESULTS

Without Dentures.—The level of the floor of the mouth in relation to the crest of the mandibular rim varied in the different subjects, depending upon the shape and depth of the lower jaw; the movements were similar in all. Details are given for one representative patient.

With the mouth open a thin line of barium suspension was present in the alveolar lingual sulcus just above the level of the upper border of the body of the mandible, and there was some barium upon the sublingual folds (*Fig.* 1 A, E). As the tongue moved forwards to be protruded, the floor of the mouth was raised very slightly and the sublingual folds became very prominent (*Fig.* 1 B, C, F, and G). With the tongue protruded the sublingual folds and frænum linguæ were pressed against the lower gum and lip (*Fig.* 1 D, H). When the mouth was opened widely its floor was raised posteriorly so that the barium in the alveolar lingual sulcus was pooled anteriorly; the sublingual folds became very prominent (*Fig.* 2).

With Dentures.—In the 10 hospital patients there was considerable variation in the degree

and type of movement of the dentures in relationship to the lower jaw; the maximal degree of movement at any point on the lower jaw was estimated to the nearest 0·25 cm. (*Table I*). Two patients showed very little movement. The appearances in 1 patient showing gross movement are described in detail (*Fig.* 3).

Fig. 7.—Photographs of the lower denture of the patient illustrated in *Figs.* 5, 6.

Fig. 4 shows the model of an alginate impression of the lower jaw of the same patient: the alveolar rim is well preserved and favourable for fitting dentures. His dentures were fitted with porcelain teeth which showed well on the radiographs, except in the lower incisor region. With the mouth at rest the tin wire fixed to the left lingual flange was below the rim of the mandibular (*Fig.* 3 A). The barium suspension was pooled at a level well above the wire, indicating that the lingual flange of the denture was dipping deep into the alveolar lingual sulcus (*Fig.* 3 A, D). With the tongue protruded to the right or forwards the denture was lifted and tilted (*Fig.* 3 B, E, C, and F). These appearances suggest that the lingual flange was too deep, particularly where it was resting upon the mylohyoid muscle.

In 10 patients who had been fitted by the perspex tray method there was less movement of the dentures upon the lower jaw (*Table II*).

The appearances in a patient who was unfavourable for fitting lower dentures are described (*Fig.* 5). She had only a small alveolar ridge on which to rest the denture, which was bony hard in the anterior incisor region but much softer and mobile upon the bone between 3–6. The depth of the soft tissue is illustrated by the relation of the crest of the mandibular region to the floor of the alveolar sulcus on the denture (*Fig.* 6). There were large sublingual folds. Photographs of her lower denture showing the shallow alveolar sulcus are shown in *Fig.* 7. Cineradiography showed that with the tongue at rest the tin wire on the inner side of the lingual flange of the denture was some distance above the mandibular rim; a thin line of barium suspension was present in the alveolo-lingual sulcus; there was more barium upon the sides of the tongue and the sublingual folds, but the sublingual folds could not be clearly seen as they were probably compressed between the sides of the tongue and the denture (*Fig.* 5 A, E). When the tongue was protruded the denture was slightly raised and barium was elevated upon the frænum linguæ and sublingual folds (*Fig.* 5 B, F). Similar appearances were seen on protruding the tongue to right and left (*Fig.* 5 C, G, D, and H). *Fig.* 8 shows that there was no movement of the denture relative to the mandible when opening and closing the mouth. The illustrations shown in *Fig.* 9 are taken from another film of the same patient, when she was chewing pieces of apple; the position of the wire in all frames shows that the dentures maintain the same position with respect to the lower jaw.

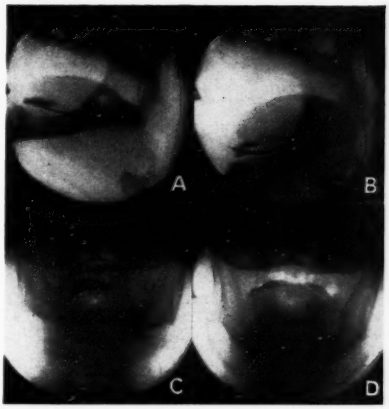

Fig. 8.—The same patient, showing the degree of movement of the denture on opening the mouth wide.

In another patient with a similar type of mouth the same appearances were seen. The cine films showed that the folds became prominent when the jaw was lowered or when the tongue was raised; the variations in appearances during chewing are illustrated (*Fig.* 10).

DISCUSSION

Dentists are agreed that the design of dentures is mainly influenced by the shape of the patient's mouth. As early as 1862, White

stated that "the plates or artificial dentures should not encroach upon the insertion or origin of various muscles that are attached to either jaw or are near enough to the alveolar process to be liable to injury". A wide range of variations of the attachments of the muscles of the jaw and in the areas which they cover preclude the use of a standard pattern. The form, extent and contours of the dentures are critically affected by irregularities in the surface and contour of the bone, and by variations in shape brought about by the process of resorption (Pendleton, 1942).

Table II.—F. R. M.'s Patients

Case No.	Age of Dentures	Movements of the Dentures			Comments
		Mouth Open and Shut	Tongue Protrusion	Chewing	
1	2 yr.	0·25–0·5 cm.	0·5 cm.	0·25 cm.	Patient claimed that she achieved maximal movement of dentures
2	7 yr.	Nil	Nil	0·25 cm.	Able to crack nuts
3	2 yr.	Nil	0·25 cm.	Nil	—
4	2 yr.	Nil	<0·25 cm.	0·25 cm.	—
5	1 yr.	Nil	0·5 cm.	Nil	—
6	2 yr.	Nil	0·25 cm.	0·25 cm.	—
7	6 yr.	<0·25 cm.	0·25 cm.	<0·25 cm.	—
8	1 mth.	Nil	0·5 cm.	>0·25 cm.	—
9	5 yr. 1 yr.	<0·25 cm. 0·25 cm.	1 cm. 0·25 cm.	<0·25 cm. 0·25 cm.	Denture changed owing to wear of plastic teeth
10	2 yr.	Nil	Nil	Nil	Very large tongue

The patient is concerned that his dentures should look well, fit well, and function properly. Many patients who tolerate ill-fitting dentures without complaint are unable to masticate properly. One of us has been particularly interested in the movements of the tongue and jaw upon the stability of artificial dentures and has investigated some aspects of the problem by still radiography (Munz and Trebitsch, 1928; Munz, 1949, 1954). It was found that the stability of the lower denture is influenced not so much by the level of the attachments of muscles to the lower jaw as upon the changes in the form of the mouth brought about by muscular activity. The perspex tray impression method enables the dentist to observe the changes in form of the floor of the mouth as the patient moves the tongue and jaw; the tray is cut away until it no longer interferes with these movements and then adapted by grinding until it fits evenly to gentle pressure.

Our cineradiographic films show that the stability of full lower dentures is mainly dependent upon the freedom of the tongue to move within the arch of the denture. Movements of the lower jaw without tongue movements are not so prone to cause displacement. The bulk of tissue comprising the tongue and sublingual structures may vary considerably in different individuals.

Dentists seem to have paid very little attention to the sublingual folds. Edwards and Boucher (1942) in their paper on the anatomy of the edentulous mouth show these folds as quite small features and state that they are due to the sublingual glands and ducts and covering mucous membrane; their account was based on studies of the cadaver. Clinically we have observed that the size of these folds

varies considerably from patient to patient and that they are usually very large in edentulous subjects who have atrophic jaws, sometimes protruding over the alveolar crest. They change considerably in size with jaw

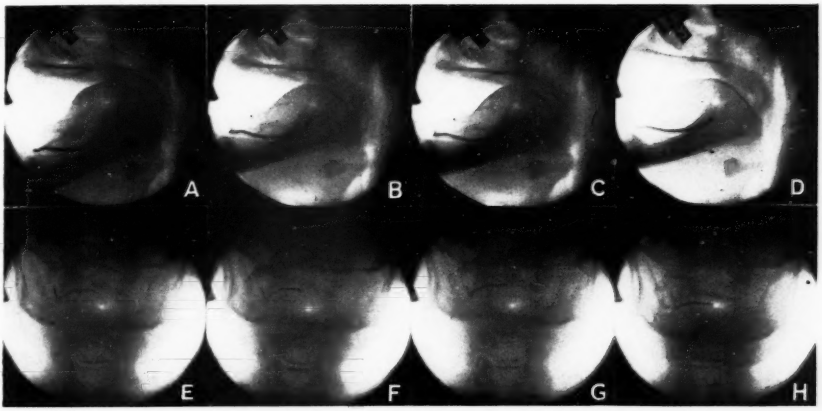

Fig. 9.—*Case* 9, *Table II.* Chewing pieces of apple.

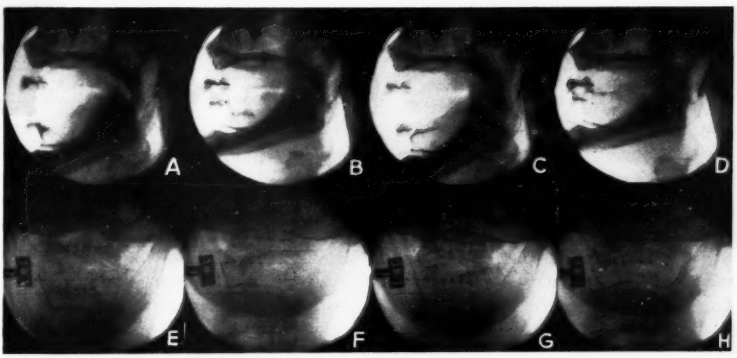

Fig. 10.—*Case* 8, *Table II.* Chewing pieces of apple. Submucous folds outlined with barium; note the alteration in appearances.

and tongue movements and it may be that the glands become swollen on chewing food. These observations indicate that the sublingual folds should be free to glide and expand within the arch of the denture. If the folds are large they should be used to assist in holding the denture in place if the lingual polished surface is correctly shaped.

The results of the present investigations have shown that cineradiography is a useful objective method for studying the behaviour of full dentures when used for mastication. From a practical standpoint it is essential that the dentures should move as little as possible during mastication: some displacement during maximal jaw and tongue movements is to be expected and may be accepted for most patients. Our series of patients is too small to permit any dogmatic assertions on the relative merits of different methods of making dentures. All but one of the Radcliffe patients had mouths which were considered favourable for fitting full lower dentures, whereas most of the patients fitted by the perspex tray method were patients who had been specially

referred for fitting after conventional methods had failed.

We would like to emphasize that our hospital patients comprise only those who made no complaints and that there were many who complained about their dentures. We have yet to learn what limits of movement of the dentures can be tolerated and recognize that the cineradiographic method may fail to detect small yet significant movements. While stressing the taking of a functional impression, it is of course understood that this is only one of the stages in making a satisfactory denture.

SUMMARY

Cineradiographs have been taken of 20 patients fitted with full lower dentures during opening and closing the mouth, protruding the tongue, and chewing. The stability of the denture is mainly dependent upon the freedom of the tongue to move within the arch of the denture; movements of the lower jaw without tongue movements are not so prone to cause displacement. The behaviour and importance of the sublingual folds is stressed. Though the series of cases examined is small, the results support the claims made for making dentures by a functional impression method.

Acknowledgements.—We are grateful to Miss Emrys-Roberts and Mr. M. S. Tuckey for their technical assistance.

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Allergic Sensitization of the Skin and Oral Mucosa to Acrylic Resin Denture Materials

Two series of cases are considered, one relating to contact dermatitis due to monomer of methyl methacrylate, the other consisting partly of cases of alleged acrylic sensitivity associated with the wearing of acrylic dentures, and partly of cases of "denture sore mouth". In the first series, patch tests and clinical histories established that each patient was suffering from allergic eczematous dermatitis due to sensitization to methyl methacrylate monomer. None of the subjects reacted to heat-processed polymer, polymer powder, or a co-polymer of vinyl acetate, vinyl chloride, and methyl methacrylate. Each reacted strongly to monomer liquids and disks made from processed self-curing acrylic. In the other series none was allergic to fully polymerized acrylic resin, but, in some, a traumatic reaction superficially similar to that found in allergic conditions was formed; histological examination showed no eczematous change. In one patient only was there an eczematous reaction to self-curing acrylic. Tests were carried out on 100 patients not wearing dentures, but under treatment for allergic conditions to see if the liquid monomer was a primary irritant. In only 1 of these patients was there a slight erythema after 48 hours. Monomer is shown to be a sensitizer but the polymer has no action of this type.—FISHER, A. A. (1956), *J. pros. Dent.*, **6**, 593.

Partial Denture Design and Its Relation to Force Distribution and Masticatory Performance

The study reported was carried out on one patient only, for whom a lower partial denture Class II, Mod. I was made. Strain gauges were incorporated to show the pressures exerted on the soft tissues, the gauges being connected to electronic recording apparatus. For the various tests the denture was progressively modified so as to become less and less rigid, and, at each modification, tests were made with interchangeable large and small occlusal tables. Peanuts were used as the test-meal. Detailed findings are given, the conclusion being that the pressures were increased with decrease in rigidity and with enlargement of the occlusal table.—KAIRES, A. K. (1956), *J. pros. Dent.*, **6**, 672.

CLINICAL PROCEDURES IN PERIODONTAL THERAPY*

By **DICKSON G. BELL**, D.D.S., *San Francisco*

THE two major diseases which the dentist must consider are dental caries and periodontal disturbances, and he has an equal responsibility in both instances. In most cases, the early indications of periodontal disease are easily recognized. When proper treatment is instituted at this time, successful results may usually be obtained with slight effort and more serious involvement prevented.

When a patient presents at your office with the complaint that the gingivæ bleed each time the teeth are brushed, that the tissues are inflamed and tender, and the teeth are becoming loose, you immediately suspect that periodontal disease is the cause of these symptoms. What would you do about it and why? What are the factors one must consider?

CLINICAL AND RADIOGRAPHIC EXAMINATION

The first essential in periodontal therapy is a complete study of all the local irritating and systemic contributing factors.

A thorough clinical examination of the gingival tissues, oral mucosa, tongue, and teeth is made. One should particularly observe the gingivæ for symptoms of pathology such as abnormal colour, inflammation, œdema, suppuration, hyperplasia, recession, and evidence of necrotizing ulcerative gingivitis (so-called Vincent's infection). The extent of periodontal pocket formation should be noted, as well as local irritation from calculus, overhanging gingival margins of fillings, faulty contacts, and ill-fitting crowns or removable appliances. The results of the patient's home care are shown by the presence or absence of calculus, materia alba, and retained food. The brushing habits are checked, along with the type of toothbrush and dentifrice used, noting the effectiveness of interproximal care and the frequency and length of time spent each day on oral hygiene. The teeth are examined for evidence of excessive stress, mobility, extrusion, migration, tilting, toothbrush abrasions, erosions, and caries. The lips, cheeks, palate, edentulous areas, and tongue should be carefully examined for any lesion or abnormal appearance of the surface epithelium. Any suspicion of the presence of blood dyscrasias should be ruled out by laboratory tests.

A complete set of radiographs should be taken, including bite-wings, to show the type and amount of bone resorption, realizing of course, that the bottom of the periodontal pocket is not at the alveolar crest and may vary to some extent. The length of the roots, condition of the alveolar bone, width of the periodontal membrane shadow, impacted teeth, fragments of broken roots or other foreign bodies, pulpless teeth, granulomas, cysts or other evidences of pathologic involvement are noted.

At this point, a comment might be made regarding full-mouth radiographs. Observation of a large number of such radiographs has shown that while they may be satisfactory for interpreting cavities and peri-apical infections, yet many of them are not satisfactory for a good periodontal diagnosis. An insufficient number of views, superimposition of teeth, and improper angulation are common faults. It must be emphasized that the diagnostic value of radiographs is dependent on a standardized technique which produces anatomically accurate reproductions of the teeth, showing their correct relationship to each other and to the supporting structures.

All of the information which has been obtained as a result of this clinical and radiographic examination, including the medical and dietary history, and any other pertinent information is recorded on some form of chart, or at least a written record should be made of it. A correlation of these findings will determine the diagnosis, prognosis, and plan of treatment.

OBJECTIVE OF THERAPY

The objective of therapy is to stop the progress of the disease and to maintain the

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teeth and their investing tissues in health and function for as long a period as possible. This should be brought about by procedures which will resolve the inflammatory process without unnecessary loss of soft tissue or alveolar bone, and reduce the depth of the pocket to as shallow a sulcus as possible. Some periodontists state that following therapy, the depth of the sulcus should be 0 to 1 mm. which incidentally, does not always occur, due to the many variables that pertain to each root surface as well as each individual patient. Other clinicians are of the opinion that where re-attachment is not obtained, the unattached tissue can become so closely adapted to the root surface as to eliminate a macroscopic sulcus. There are cases where this close adaptation does not occur and a residual sulcus of 2, 3, or 4 mm. is the best result that can be obtained. Orban (1948) states, "One must differentiate between a sulcus and a pocket. If the symptoms of inflammation are absent, the area between the tooth and the gingiva is a sulcus, regardless of its depth. If the gingival tissues are inflamed, the area is a pocket no matter whether it is shallow or deep." The question which must be decided in the operator's mind is whether he will accept this condition of a moderately deep sulcus without clinical symptoms of pathology as a satisfactory response to treatment or whether this sulcus should be eliminated by surgery. A deep sulcus certainly has a greater potential of developing subsequently into a pathologic pocket than a shallow one, but this possibility is reduced by adequate supportive care, i.e., periodic prophylaxis and proper oral hygiene. While this may not be the ideal condition, yet clinical observation of many such areas has shown that they can be maintained for years without recurrence of inflammation or further resorption of bone.

There are several clinical procedures for treating periodontal disease, including subgingival curettage, gingival resection, electrosurgery, and chemosurgery. We will discuss the first two—curettage and resection, since they are most frequently used in periodontal therapy.

The type of local treatment selected depends on the character of the lesion about the individual teeth and on the overall diagnosis. In many cases results obtained by subgingival curettage are such that it is the only procedure necessary. In some cases, initial subgingival scaling is done to remove the local irritating factors, thereby reducing the inflammatory process and improving tissue resistance before performing surgery. In other cases, gingival resection is the initial method of treatment that is indicated. The lesions often vary in the same mouth and consequently may require a combination of different procedures. All methods of therapy have advantages and disadvantages and only through a knowledge of the histologic findings and healing potential can sound judgement be developed.

SUBGINGIVAL CURETTAGE

Menkin (1953) states, "Inflammation is a manifestation of a severe cellular injury. . . . Cellular injury by an irritant alters the internal cell biochemistry with the liberation of various common denominators which reasonably explain some of the biological manifestations of inflammation." An irritant may be defined as any agent of a physical, chemical, thermal, or bacterial nature that interrupts normal cellular metabolism. The inflammatory process can be reduced by removal of the irritating factors. Therefore, the rationale of subgingival curettage—the establishment of favourable conditions which enable the periodontal tissues to repair the lesion. This is accomplished by removal of the local irritation, curettage of the surfaces of the tissues forming the pocket and retention of the blood-clot.

Treatment.—The selection of proper instruments is always an important consideration in any operative procedure. For subgingival curettage, the spoon-shape or curette type of instruments are preferred because they permit strokes in all directions and it is possible to reach the bottom of the pocket with greater ease and more thoroughly than with the hoe or straight-edge instruments. The shank and blade are very thin and so shaped that in most instances the deposits of calculus may be removed and all surfaces of the teeth more smoothly curetted than with the hoe type of scaler, especially in pockets having a narrow

orifice. They are also suitable for curettage of the soft-tissue walls of the pocket.

The treatment of the lesion consists of removing all of the debris and calculus, beginning with that which is exposed and gradually working along the root surface of each tooth. A light and even stroke of moderate length with very sharp curettes is essential. The surface of the cementum is thoroughly planed, making certain to reach the bottom of the pocket around the entire periphery of each tooth. Since there is a layer of epithelium and connective tissue between the base of the pocket and the alveolar bone, the bottom of the pocket is determined clinically by one's tactile sense and not by the radiographs. In subgingival curettage, the pockets should be treated in a methodical manner, commencing at some definite point in the mouth and proceeding from tooth to tooth until all have been treated. The curettage around one tooth should be thoroughly finished before proceeding to the next one and only as many pockets should be treated as can be completed at that appointment. The treatment of pockets on the mesial and distal surfaces of the teeth in an interdental area should be completed at the same appointment. On completion of the curettage, an explorer or other suitable instrument should be used to check the condition of the root surfaces.

The final step in subgingival therapy is to leave a clean wound and establish a good blood clot. In many cases, it is an advantage to protect the curetted area with a surgical cement dressing. In this instance, it is not used as a pack in gingivectomy, but mixed to a thinner consistency and carefully applied so that the clot will not be disturbed. This dressing should be maintained for at least one week or longer if indicated. The scaling and curettage in pockets of moderate depth can frequently be done without undue discomfort or pain to the patient, but there are cases where a topical or injected anæsthetic is necessary to accomplish the objective of therapy. Effective subgingival curettage depends on the thoroughness with which it is performed. Radiographs should be used during treatment for correlation with the clinical conditions as to the location, type, and approximate depth of the pocket.

GINGIVAL RESECTION

There are some conditions of the gingival tissues and some types of pockets which are unfavourable for subgingival therapy. Also in cases previously treated by scaling and curettage, there may be areas which have not responded or the inflammation and suppuration have recurred. In these instances, excision of all or part of the involved tissues is then necessary. The surgical techniques which might be used include gingivectomy, papillectomy, and gingivoplasty.

Gingivectomy.—Gingivectomy is the removal of the detached gingival tissues to the bottom of the pocket to eliminate the soft tissue side of the pathologic pocket. The principal items of the armamentarium are gingivectomy knives, a small pair of scissors, spoon curettes, and a zinc-oxide–eugenol dressing.

The first step is to obtain anæsthesia of the area to be operated. The depth of the pockets is then determined and with a periodontal probe, explorer, or other pointed instrument, small punctures are made on the facial and lingual tissues at the proper distance from the gingival margin to indicate the base of each pocket. The incision is made in a continuous manner along a line slightly apical to the puncture points, thereby following the bottom of the pocket on both the facial and lingual surfaces so as to produce a satisfactory bevel of the operated gingivæ. The loose tissues are removed and the bleeding controlled by packing with gauze—in the interproximal areas the use of gauze twills is more convenient. The resected area is then carefully examined for any remaining granulomatous tissue, which is removed with curettes. All deposits of calculus should be removed at this time and the surfaces of the cementum, especially at the base of the pocket, thoroughly planed with curettes or files.

The incision should be deftly made with very sharp knives, leaving no ragged edges or tags. Should such occur, they may be removed with a pair of suitable scissors. The next step is to allow a blood-clot to be established. A surgical cement dressing is then carefully

applied over the entire wound surface with only sufficient pressure for retention and without disturbing the blood-clot. The material should be mixed to a consistency which allows it to be easily rolled between the fingers. This dressing provides a protective covering for the tissues during the healing period. It should be removed in about seven days, the area irrigated with warm water or a saline solution, and the surface of the wound and adjacent tissue cleaned with cotton saturated in a weak solution of hydrogen peroxide. Any excessive proliferating granulation tissue on the wound surface is treated with trichloracetic acid. The dressing is replaced and should be maintained for at least ten days or until such time as the epithelium has covered the wound. The patient must be cautioned not to do anything which might disturb the dressing, such as brushing the area or eating on that side of the mouth. Careful brushing of the remainder of the teeth should, of course, be continued. Proper oral hygiene of the operated area should be instituted on removal of the dressing and daily use of the interdental stimulator should be stressed.

Gingivectomy is generally limited to particular types of pockets or conditions about one or several teeth. It is the unusual case that would require gingival resection throughout the entire mouth. Should the operator decide that such a procedure is indicated, it is best to operate not more than one quadrant at any appointment. Resection of acutely inflamed gingival tissue is contra-indicated because of the accumulation of bacteria and toxic products. In such cases, the procedure is to remove the local irritating factors by scaling and reduce the inflammation as much as possible prior to the gingivectomy.

Papillectomy.—Papillectomy is the excision of the interdental papilla, without involving the marginal gingivæ. This procedure is used in areas where the papilla is detached, flabby and œdematous, or where the inflammation has not been reduced by removal of the local irritation. Such papillæ are frequently irritated by impingement of food during mastication. This loose tissue also offers an excellent opportunity for accumulation of debris between it and the tooth surface. They are frequently hæmorrhagic and bleeding occurs with but slight pressure from the toothbrush. The interproximal knives are used for removing the papillæ. The line of incision should be elliptical especially in the anterior region and at a 45° angle, the purpose being to form an inclined plane and interproximal sluiceway for the excursions of food. The surgical cement dressing in this instance should be of stiff consistency and firmly packed into the interproximal space. Post-operative care is as for gingivectomy. A combination of papillectomy and subgingival curettage is occasionally used in treatment of deep intrabony pockets.

Gingivoplasty.—Gingivoplasty is the reshaping of any abnormal contour of the gingivæ so that a better architectural form may be obtained. This technique is used in areas where the normal festooning of the gingival margin has been lost and a thickened shelf-like condition has developed, and also in cases of necrotizing ulcerative gingivitis where following treatment, the interdental gingivæ have a cup-shaped or crater formation. These improper anatomical conformations have a tendency to retain food debris and subsequent gingival inflammation will occur. Since no deep periodontal pocket is present, the incision is usually shallow with only the surface tissue removed. It should also be made at an angle or bevelled to obtain more ideal tissue contour and restore a thin knife-like gingival margin. A surgical dressing is applied when several adjacent areas are treated and the usual post-operative measures are followed.

Electrosurgery has been used very successfully in gingivoplasty and some operators prefer this technique instead of the scalpel.

A discussion of therapy would not be complete without mentioning that there are several other surgical procedures, such as the flap operation, the modified flap technique and the semilunar flap. They may be indicated in specific instances where removal of the gingiva to the bottom of the pocket is contra-indicated for æsthetic, architectural, and other reasons. Osseous resection is another periodontal procedure advocated by some periodontists for reshaping the crest of the alveolar bone in intrabony pockets and molar bifurcations.

THE PROBLEM OF PERIODONTOSIS

One of our most difficult problems is that of periodontosis (diffuse atrophy-Gottlieb) because of its unknown aetiology. It is the degenerative type of periodontal disease often found in young patients, and characterized by sporadic deep-pocket formation, extensive vertical bone resorption and migration of the anterior teeth. In a true periodontosis there are no clinical symptoms of inflammation (gingival redness or bleeding occur as a secondary symptom). It is possible in many of these cases that some predisposing systemic influence, such as a faulty nutrition, endocrine dysfunction, or some other metabolic imbalance has lowered the periodontal tissue resistance. These possibilities should be medically investigated. The published investigations on the systemic aspects of periodontal disease have shown the inter-relationship that exists between general body health and the periodontal tissues. Local treatment of these cases should be instituted and the condition of the periodontal tissues may be improved with treatment of any abnormal systemic condition. By the time some of these cases are brought to our attention, there is often no evidence of any particular systemic disorder, even after a thorough examination by the patient's physician. In many instances severe periodontal tissue damage has occurred and the case has progressed into the inflammatory stage or periodontitis complex. Hence early diagnosis by the general practitioner and treatment of periodontal disease in young patients is especially important.

HOME CARE

Thorough instruction in proper home care is a very important therapeutic procedure. Clinical observation has shown that the majority of periodontal patients do not know how to properly care for their mouths because they have received no instruction from their general dentist. The selection of a toothbrush should be made on the basis of an analysis of the objective—namely the removal of the soft debris adhering to the surfaces of the teeth and the development and maintenance of good gingival tissue tone. A satisfactory type of brush is one having many tufts with small diameter bristles of moderate length and a flat or level trimmed brushing surface—the so-called straight toothbrush. The many bristles will cover more area of the tooth surface, thus producing a more effective cleaning result and with less danger of traumatizing the gingival margin. Good mouth hygiene means not only the correct use of the toothbrush but also thorough care of the interproximal areas. The agents used for this purpose are dental floss, dental tape, soft wood points, and soft rubber cones. Each has its particular indication, depending on the height of the septal tissue or size of the interproximal space and should be suitably prescribed by the patient's dentist. The cleaning of the tongue should also be recommended as a daily procedure and the type of brush just mentioned is an excellent agent for this purpose. The principles of correct mouth care should be discussed with the patient and the most effective method of instruction is to take the toothbrush, dental floss, soft wood points, or interdental stimulator and actually demonstrate their use in the patient's mouth. Repeated demonstrations are often necessary before they learn to do it correctly. The patient should not be dismissed until he has shown his ability to properly care for his teeth and investing tissues. The success or failure of periodontal therapy depends not only on the good judgement and ability of the operator but also on the co-operation of the patient. The significance of this fact must be fully emphasized to the patient. Effective home care is a therapeutic procedure equal in importance to that of treatment of the periodontal lesion.

There are other factors which must be considered in periodontal therapy, such as relief of excessive stress and placing the teeth in the best possible occlusal balance; the stabilization of mobile teeth with temporary or permanent splints; the investigation of any nutritional deficiencies, nervous habits, and psychogenic problems. The physical condition of the patient must also be considered since it is often a predisposing or contributing factor in producing degenerative changes in the alveolar bone or in lowering gingival tissue resistance.

Time will not permit more than this brief mention of several of them and that the correction and elimination of these conditions will result in a more satisfactory response of the tissues to subgingival curettage and gingival resection.

SOME INDICATIONS FOR SPECIFIC THERAPY

Undoubtedly, this question is in the minds of many of you—"When shall I use subgingival curettage and in what cases shall I do gingival resection?" To decide whether curettage or resection is indicated in any particular case is often difficult for the general practitioner.

It is not a matter of one method being superior to another but which procedure will reduce the inflammation, restore the tissues to physiologic health and ensure the maximum amount of function. In the majority of periodontal pockets, subgingival curettage is the procedure that should first be instituted. Subsequently, if there are pockets that do not respond as anticipated after curettage and there is persistence of the inflammation, then resection of the gingival tissue is necessary.

There are some specific conditions where subgingival curettage is contra-indicated and gingival resection is the method of treatment that should be first employed. For example:—

1. Loose gingival flaps and pedunculated papillæ.

2. In cases of periodontosis showing migration of the teeth, deep pocket formation, and loss of bone.

3. Where there is extensive destruction of both the interproximal soft tissue and bone, such as is often found in cases having had recurrent necrotizing ulcerative gingivitis. In these cases, the height of the facial and lingual gingival wall is reduced to the bottom of the interproximal pocket to enable better home care of the area.

4. In those pockets where the gingival tissue is thin with no marked inflammatory reaction and where there is an absence of irritating factors, such as calculus.

5. Areas of chronic fibrotic gingival hyperplasia where prophylaxis, curettage, toothbrushing and interproximal stimulation will not reduce the tissue to normal contour.

It must be again emphasized that these specific periodontal conditions are generally not found throughout the entire mouth but usually only around one or several teeth. One must generalize somewhat in outlining the indications for therapy as there are always individual problems which must be considered, such as the patient, the clinical conditions and the experience of the operator.

Cases have been observed where the gingival tissues have been resected regardless of the aetiological factors, the status of the gingiva, or the depth of the pockets. One reason for this situation is the over-emphasis which has been given to the removal of all detached tissue. This undoubtedly has led many to assume that resection is the indicated and most satisfactory procedure in every case. Consequently, there are many cases of simple gingivitis which are treated by gingivectomy, where a thorough scaling or prophylaxis would have reduced the inflammation and corrected the condition.

The general practitioner has an important role in the prevention, diagnosis, and early treatment of periodontal disease since he sees the patient at least once or twice a year and thus has him under periodic observation.

Gambill (1945) emphasized this point when he stated that "Periodontal disease is one that should be treated before it develops".

SUMMARY

1. A thorough clinical and radiographic examination is necessary for a correct diagnosis, plan of treatment, and prognosis.

2. The clinical procedures advocated for periodontal therapy including subgingival curettage, gingivectomy, papillectomy, and gingivoplasty are described.

3. The problem of periodontosis is discussed.

4. The importance of proper toothbrushing and interproximal care is emphasized.

5. Several specific periodontal conditions where subgingival curettage is contra-indicated are enumerated.

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INSTRUMENTS*

I. BIOLOGICAL CONSIDERATIONS

By A. BRYAN WADE, B.Ch.D., F.D.S. R.C.S.

THERE is general agreement that accumulation of debris and the formation of calculus within the gingival crevice irritates the marginal gingiva. This irritation produces a simple inflammatory response which may be followed by either a destructive or proliferative change, while occasionally a combination of both these reactions is observed.

As long as the response remains simple, that is, there is no pocket formation, removal of the accretions allows resolution. When true pockets have formed, however, the problem becomes more profound and a decision has to be made between scaling alone, excision of the detached gingival tissue or an operation designed to produce tissue regeneration and reattachment.

Any consideration of the design of scalers and curettes must be based on a realization that, with the one exception of the intrabony pocket, one is concerned principally with pockets which are certainly not deeper than 4 mm., though the problem of access to proximal aspects, due to contact between adjacent teeth, should never be forgotten.

Gingival pockets deeper than 4 mm. cannot be reduced to 2 mm. or less by either scaling or curettage and demand a gingivectomy. Calculus should be removed from such pockets some time before the surgical intervention, but perfection of scaling and root planing is not then so essential as when no gingivectomy is to be performed.

SCALING

If scaling is the operation of choice there are certain factors which must be considered when designing instruments. These are the relation of calculus to the pocket wall, the compressibility of the gingival wall of the pocket, the nature of the calculus attachment and any cemental changes. Furthermore, the nature and extent of the epithelial attachment as well as its relation to the underlying bone, cannot be ignored, although these have a greater bearing on curettage.

Relation of Calculus to the Depth of the Pocket.—There is still some uncertainty about whether or not calculus is deposited to the very depth of the pocket. Formerly, many thought that it never reached such depths, but it seems probable that their opinions were based on the examination of histological sections in which tears had occurred (*Fig.* 1).

Fig. 1.—A longitudinal section of an interdental area showing how the gingival papilla has shrunk but maintained a configuration suggesting that the pocket wall was in contact with the calculus. Tearing has probably occurred in the epithelial attachment. (× 21.)

Relation of Calculus to the Pocket Wall.—In most histological sections a space appears to exist between the calculus and the

* From a Symposium on Instruments given to the British Society of Periodontology on Nov. 19, 1956, at the Eastman Dental Hospital.

soft-tissue wall of the pocket, but this is almost certainly due to tissue shrinkage during fixation. Careful examination shows a configuration of the epithelial surface which conforms to the contours of the calculus (*Fig.* 1). Even though this suggests that the pocket wall normally lies in contact with the calculus

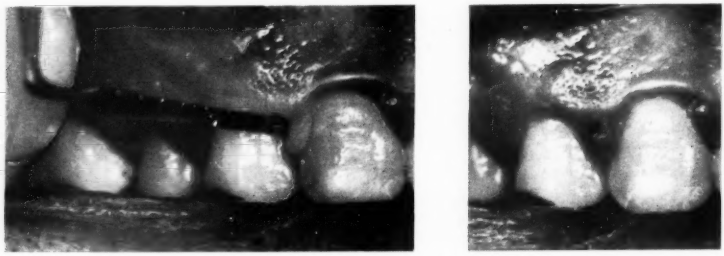

Fig. 2.—Pitting of œdematous gingiva.

Fig. 3.—Compression to the extent of a millimetre of fibrosed gingiva.

it must be appreciated that this soft tissue can be displaced easily.

Compressibility of the Gingival Wall of the Pocket.—Being inflamed and so containing excess tissue fluid, the gingival wall of the pocket usually exhibits pitting (*Fig.* 2), but even when a proliferative response has ensued, the tissue can usually be compressed by at least a millimetre (*Fig.* 3).

Nature of Calculus Attachment.—Little attention had been paid to the precise way in which calculus is attached to cementum until Zander (1953) and Schroff (1955) made investigations. Zander found that attachment might be by means of the secondary cuticle; by insertion of the organic matrix of the calculus into the minute spaces previously occupied by Sharpey's fibres; by penetration of the micro-organisms into the cementum; or into areas from which cementum has been resorbed. These findings not only affect considerations regarding the need to remove cementum when scaling if no nidus of calculus is to be left, but also account for the varying degrees of difficulty encountered in removing subgingival calculus. Schroff (1955) investigated a block of six mandibular anterior teeth and found that in the middle third of the deposit the attachment was very strong with no evidence of a cuticle, whereas coronally and apically, where a cuticle was apparent, it became progressively weaker.

Cemental Changes.—Not only may cementum present an irregular surface due to uneven deposition or resorption, but it may also undergo changes in consistency (Riffle, 1952)., Riffle (1956) believes that this deterioration leaves a surface which is itself irritant, indeed, he considers it to be more irritant than the calculus which tends to deposit easily on this changed surface. If his claims are correct, planing of roots must be extremely thorough and for this reason alone the use of tungsten carbide would seem to be justified.

Egli (1955) supported Gottlieb's theory that cemental changes occur ahead of epithelial downgrowth.

CURETTAGE

Curettage involves not only the removal of deposits and planing of the root surface, but also elimination of the epithelial attachment and the epithelial lining of the pocket. Thus, when it is to be undertaken, in addition to the

biological considerations involved in the removal of calculus, account has to be taken of the nature of the epithelial attachment, its extent, the relation of its apical limit to the bone crest and the soft-tissue wall of the pocket.

It seems unlikely that a significant degree of reattachment can be attained except in intrabony pockets (Gottlieb, 1946; Goldman, 1948 and 1953), although histological evidence of reattachment in simple pockets has been produced (Schaffer and Zander; 1953; Cross, 1956). Curettage of intrabony pockets presents special problems and is probably accomplished most successfully at open operation, when access and vision are good.

Nature of the Epithelial Attachment.—Argument still rages about the existence of any true attachment between the epithelium and the tooth. It must be realized, however, that most investigations of this subject have been concerned with the relation between epithelium and enamel, whereas when subgingival curettage is required the epithelium is adjacent to the cementum.

Contact between epithelium and a hard tissue was believed by Orban (1953) to be responsible for the formation of the keratinous dental cuticle. Meyer (1930) claimed that this cuticle was produced by an inflammatory process and Orban even went so far as to state that its formation is the first phase of the process which ultimately leads to separation of the epithelium from the tooth. Yet Orban (1953), Bödecker and Applebaum (1934), and many others consider the insertion of the cuticle into the spaces formerly occupied by Sharpey's fibres to be the means of attachment of the epithelium to the cementum.

Ramfjord (1951) concluded from experimental reattachment investigations on monkeys that attachment was by tonofibrils utilizing microscopic roughness in the denuded dentine.

It would seem that this problem requires investigating possibly even more than the relation of the epithelium to the enamel, for there is little doubt that the so-called third and fourth stages of passive eruption are commonly found in adults and after root planing it is frequently a question of attachment to dentine.

Extent of the Epithelial Attachment.—Little attention appears to have been given to the length of the attachment, although if this is to be removed, this factor must be related to instrument size. Orban and Kohler (1924) found a variation of between 0·25 mm. to 6 mm. Waerhaug (1952), when measuring 220 cases, found an average length of 1·16 mm., and Stanley (1955) on 67 teeth recorded 0·57 mm. varying between 0·1 mm. and 1·4 mm.

Table I.—Length of Epithelial Attachment when wholly on Cementum

Number of Attachments Measured	*Minimum Length of Attachment*	*Maximum Length of Attachment*	*Average Length of Attachment*
100	0·38 mm.	2·73 mm.	0·86 mm.

Table II.—Length of Anatomical Root

Number of Measurements	*Minimum Length*	*Maximum Length*	*Average Length*
100	11·7 mm.	19·4 mm.	15·2 mm.

To check these observations, a count was made of one hundred sections exhibiting suprabony pockets not deeper than 4 mm. in which the epithelial attachment was entirely on the cementum. It was found that the range was between 0·38 mm. and 2·73 mm., the average being 0·86 mm. (*Table I*).

Measurements of the anatomical roots of 50 teeth on both proximal aspects revealed an average root length of 15·2 mm. (*Table II*). Should the epithelial attachment be removed at curettage and should there be no reattachment, the very sobering thought occurs that bi-annual curettage would, after 9 years, eliminate the tooth! Presumably some degree of reattachment is a not uncommon event if, indeed, our instruments normally remove the epithelial attachment, even though definite evidence of reattachment after curettage in humans has been shown only by Schaffer and Zander (1953) and Cross (1956). Ramfjord and Kiester (1954) did, in fact, show extensive damage to the epithelial attachment when only scaling was being attempted.

Removal of the epithelial attachment, if a gingivectomy is to be performed, seems

irrational and Ritchey and Orban (1952) have advised against this practice.

Relation of the Apical Limit of the Epithelial Attachment to the Bone Crest.—Any instrument to be used subgingivally must be fine

Fig. 4.—The end of a hoe tipped with tungsten carbide showing rounded corners and an elliptical end manufactured by the Amalgamated Dental Company. (× 5.)

enough not only to allow insertion into the pocket, but also to pass to the deepest point. As the degree of compressibility of soft tissue against hard tissue is severely limited, it

Table III.—Distance from Apical Limit of Epithelial Attachment to Bone Crest

Number of Cases Measured	*Minimum Distance*	*Maximum Distance*	*Average Distance*
100	0·48 mm.	1·82 mm.	0·97 mm.

appeared worthwhile to make an assessment of the vertical distance between the attachment and the underlying bone.

Measurements of 100 sections chosen as before revealed an average of 0·97 mm. (*Table III*), compared with 0·78 mm. found by Waerhaug (1952). This, all will agree, is not a very considerable distance and must have a bearing on instrument design and size, for it means that the average distance from the base of the pocket to the underlying bone in suprabony pockets is 1·83 mm. Waerhaug (1952) found it to be 1·94 mm. and Stanley (1955) 1·97 mm.

Soft-tissue Wall of the Pocket.—When the lining epithelium is ulcerated due to irritation from calculus, there is usually considerable epithelial proliferation. This fact makes complete removal difficult, but if scaling is done prior to curettage, there is healing of the ulcer and a reduction in the thickness of the epithelium, thus making instrumentation more effective (Cross, 1955).

DIMENSIONS OF INSTRUMENTS

Bödecker (1943) and more recently Waerhaug, Arno, and Lovdal (1954) and Orban and Manella (1956) have drawn attention to the dimensions of instruments suitable for the removal of subgingival calculus. Waerhaug and others and Orban and Manella made recommendations; those of the latter having been accepted in the designs of a set of hoes with tungsten-carbide tips now manufactured by The Amalgamated Dental Company (*Fig.* 4). Consideration of instrument design and dimensions is, however, the lot of my colleagues, who have agreed to superimpose instruments on a standard photomicrograph of pockets measuring 2·8 mm. and 2·7 mm. with an interdental width of 2·4 mm. between the deposits of calculus at the bases of the pockets (*Fig.* 1).

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II. HOES AND CURETTES

By **W. G. CROSS**, M.S., M.B., B.D.S.

In this section it is intended to consider principally hoes and curettes, both regarding design and choice of steel.

During recent years, attention has been focused on the design of the periodontal instruments used for the removal of deposits, particularly as regards their dimensions. The shape of instrument heads has varied little during the past forty years. Attention has been drawn by many workers to the fact that the blade requires to be small in dimensions, and two important references in recent years are those of Waerhaug (1954) and Orban and Manella (1956). Waerhaug (1952) has shown that the distance between the bottom of the pocket, where this lies below the enamel-cementum junction, and the bottom of the calculus varies from as little as 0·2 mm. in the deeper pockets to as much as 2 mm. The deeper the pocket, the smaller the distance between the bottom of the calculus and the bottom of the pocket. Waerhaug also showed that a very small interdental space, which may be as little as 0·5 mm. is present between certain teeth. He showed photomicrographs of teeth with their supporting tissues, onto which were superimposed photographs of hoe scalers to the correct scale. He did not refer in this article to the depth of the hoe blade, but the width from the cutting edge to the back of the shaft, and he referred to the complete unsuitability of standard hoes of width 1·25 mm. for the removal of deep calculus. He advocated the use of a hoe of only 0·4 mm. in width, with which it was always possible to remove the deepest calculus present. He considered that there is always a space between the bottom of the calculus and the bottom of the pocket. In Waerhaug's opinion this refutes Orban's view that the bottom of the pocket and the lowest point of the calculus are at one and the same level, as, if this were the case, not even the smallest instrument could remove the calculus.

Orban and Manella (1956) referred to three governing principles in the design of instruments for root planing.

1. They should be mechanically designed to give scope to the operator's greatest dexterity.

2. The working tips of the instruments should be specifically designed for efficiency of instrumentation.

3. They should be designed so as to cause as little damage as possible, both to the gingival tissues and tooth structures.

He referred to hoe-shaped instruments as being intended for the removal of easily accessible calculus and that they should be used subgingivally only when the gingiva is flabby and is easily displaced. Further, such instruments should not be pushed to the bottom of the pocket, as they are bulky in design. Minimum and maximum measurements in mm. for hoes in his chart are: shaft thickness 0·35 and 0·6; width of head (cutting edge to back of shaft) 0·65 to 1·2; depth of head 0·5 to 0·95. With regard to curettes, Orban stated that these can reach below the calculus when used at an angle of 25°, without injury to the tissues at the bottom of the pockets. He pointed out, however, that this is not an efficient angle. He suggested that the term 'curettage' should be reserved for the removal of soft tissues, although one notes that the general surgeon uses the term both for soft and hard tissues. Another factor considered by Orban was the rake angle—the angle formed by the junction of the upper surface of the blade with the shaft. This angle is, with many instruments, a right angle, but Orban suggested an increase of this

angle to 105°; I have had no experience with this increased angle.

Hoes and curettes are the two most useful types of instrument used in the removal of subgingival deposits and for final planing of the root surfaces. I feel that Orban is somewhat sweeping in the limitations he placed on the use of hoes; he may have placed these limitations, of course, on account of the relatively large size of such hoes as are at present available on the American market. Subgingival deposits may be very superficial (1–2 mm.), or they may reach the apex of the tooth, to give an extreme example. Instruments to deal with calculus in these situations must obviously vary in design. For the removal of superficial subgingival calculus the curette is probably the most useful instrument; with its rounded undersurface, it can be inserted into the crevice or pocket, causing minimal harm. It is not always so easy to use in the deeper pocket, especially where this is localized to one aspect of the tooth and has a relatively narrow width of orifice, the hoe often being better suited for this purpose. If hoes are to be used for the removal of calculus at the bottom of deep pockets, the following considerations concerning dimensions apply:—

1. *The Shaft.*—This must be of adequate length from the angled portion down to the blade. A suitable suggested length is 12–13 mm. Width of the shaft should not exceed 1·25–1·5 mm. and thickness, which tapers from the angle down to the blade, should not exceed 0·85 mm. near the angle or 0·65 mm. near the tip. The shaft should be straight from the angle down to the blade. Some instruments are designed with a curvature, or set concavity towards the tooth, which in many cases makes it difficult for the instrument to be held at the required angle to the tooth surfaces.

2. *The Blade.*—This should have the same width as the shaft and its length from cutting edge to back of the shaft should not exceed 0·75 mm., and the depth should not exceed 0·5 mm. The back of the shaft should be rounded where it joins the under-surface of the blade.

Type of Steel.—Until recent years, instruments have been constructed in carbon steel or even stainless steel. As a result, the cutting edge retains its sharpness for a very limited time and, in general, one will have to have recourse to sharpening almost every time the instrument is used. The ability to keep an edge is dependent upon the original alloy used and the heat treatment to which it has been subjected, both of which vary with different manufacturers. Just over two years ago a Swedish firm constructed a series of periodontal instruments, including hoes and curettes, in tungsten carbide; not merely the blade, but the whole of the shaft of the instrument was made of this metal. The curettes were too thick in all dimensions and the blade was placed at an unsuitable angle. The hoes, however, were of very much better dimensions but the shafts were too thick. The instruments were not uniform of dimensions as between one set and another, and the price in this country was extremely high. A set of hoes of Danish manufacture became available at the beginning of this year with tungsten blades soldered to the tips of the carbon-steel shafts. These represented a considerable improvement, but some of the dimensions were not acceptable, nor the curvature of the shaft in the left and right instruments. I therefore approached one of the dental companies (The Dental Manufacturing Company) with a view to the construction of tungsten-tipped instruments of a slightly different design, and such instruments have been produced and have been in use by myself for about seven months, and are now available.

The dimensions of these instruments are, on average, shaft thickness 0·55 mm.; blade length (cutting edge to back of shaft) 0·75 mm.; blade depth 0·34 mm.; these instruments can be compared with others in *Figs.* 5, 6, and 7, where they are shown superimposed to the correct scale, against photomicrographs of teeth with pockets. More recently, another dental company (The Amalgamated Dental Company) has designed a tungsten-tipped hoe, soldered rather differently, with the following average dimensions: shaft thickness

0·65 mm.; length of head 0·75 mm.; depth of head 0·85 mm.

The outstanding advantage of tungsten instruments is that they will keep an exceedingly good edge completely unimpaired for very long periods of time, and will readily remove cementum. I have, for example, only once sharpened a set of the Swedish instruments in 21 months, and these instruments have been used very constantly.

I wish to stress the value of these instruments in making the removal of subgingival deposits relatively easy, whilst blunt ones make it almost impossible. Fine carbon-steel instruments of these dimensions are not very easy to sharpen and in many cases sharpening will not be carried out. Where it is carried out, lack of care and frequent sharpening will rapidly result in a useless instrument and thus large numbers of instruments will be required.

It seems, therefore, that the initial increased cost of tungsten instruments will, provided they are correctly handled, rapidly be repaid from every point of view.

Attempts have been made to construct curettes with a tungsten cutting edge, and although some instruments have proved satisfactory, others have fractured. There is, too, the difficulty of tempering instruments which have been soldered, as the temperature necessary prior to quenching approximates

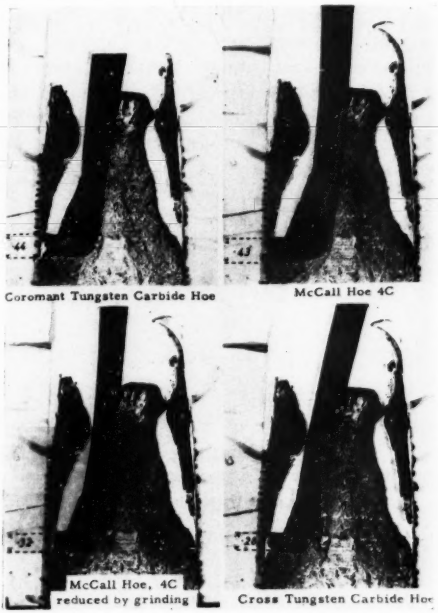

Fig. 5.—Comparative size of four hoe scalers.

Fig. 6.—Comparative size of a curette and file.

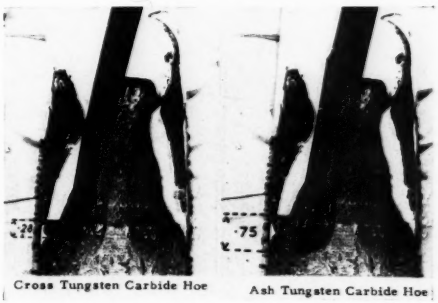

Fig. 7.—Comparative size of two hoe scalers with tungsten-carbide blades.

that of the melting point of the soldering medium used. It may be, however, that this can be overcome in the future. This, too, would present a big development in periodontology since hoes and curettes are not interchangeable. It is, for example, essential to use curettes for the removal of soft tissues, including epithelium.

SUMMARY

Calculus varies in volume and distribution and instruments suitable for the removal of superficial deposits will not be suitable for the removal of small deep deposits. Hoes and curettes of different dimensions are suitable for these purposes and very considerable advantages result from the use of instruments with tungsten-carbide blades. It is considered that the production of tungsten-bladed periodontal hoes represents a major advance in periodontal treatment.

I would like to acknowledge my thanks for the photographs to Mr. Fanibunda, Department of Pathology, and to the Photographic Department, Institute of Dental Surgery. I would also like to express my thanks to the Dental Manufacturing Company for their co-operation in the production of tungsten-carbide hoes to my design.

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III. OTHER INSTRUMENTS

By **R. D. EMSLIE**, M.S. (Ill.), B.D.S., F.D.S. R.C.S.

The difficulties of subgingival scaling depend mainly upon the depth of the pocket, but another important factor is the ease with which the free gingiva may be retracted from the tooth to permit passage of the instrument. When the pocket is shallow, the gingival inflammation mild, and the free gingiva hugs the tooth and calculus tightly, it may not be possible to use any of the instruments so far described for subgingival scaling without considerable gingival trauma.

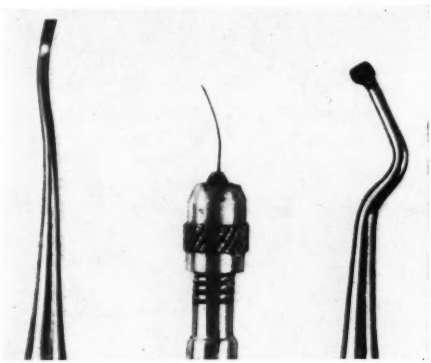

Fig. 8.—Photograph of a "watch-spring" scaler (Ash G.1.), a piece of actual watch-spring in a broach-holder, and a contra-angled spoon excavator. The spoon excavator has been ground to a straight chisel-edge. (× 1·8.)

Three very simple instruments can be used in these conditions: the "watch-spring" scaler (push or chisel scaler); an actual watch-spring; and a spoon excavator (*Fig.* 8).

The end of the spoon may be ground to a chisel-edge as shown. This should assist in obtaining a smoother root surface, but does restrict the regions in which it may be conveniently used.

Fig. 9 shows the relative sizes of a "watch-spring" scaler (Ash G.1.) and the histological specimen. This is not the super-imposition of an actual instrument, but is a paper cut-out to the scale of the photomicrograph.

Before describing these instruments a little more might be said about the histological specimen. It is, of course, difficult to determine in a decalcified section how much of the material within the pocket and loosely termed calculus was actually calcified *in vivo*. In this specimen the material in contact with the cementum appears to consist mainly of cellular debris, and would certainly have been soft. Very little mechanical force would have been required to remove this deepest portion

within the pocket—perhaps a stream of water would have been sufficient.

Nevertheless it does appear to be necessary to scale this part of the cementum. Wade has referred to the work of Zander (1953) and others who have presented histological evidence of thread-organisms within resorption areas and also in spaces left by Sharpey's fibres.

Fig. 9.—Diagram of a cross-section of a "watch-spring" scaler (Ash G.1.) superimposed upon a photomicrograph of the specimen. (× 31.)

Fig. 10.—Diagram of a cross-section of an actual watch-spring superimposed upon a photomicrograph of the specimen. (× 31.)

Fig. 11.—Diagram of a longitudinal section of a spoon excavator superimposed upon a photomicrograph of the specimen. (× 31.)

Fig. 12.—Diagram of a cross-section of the blade of a Gracey curette superimposed upon a photomicrograph of the specimen. (× 31.)

When this cementum is cellular, organisms will also be able to penetrate the canaliculi and lacunæ. In addition there is some evidence that a chemical change occurs in the root dentine which has been exposed to toxic substances from the pocket. Riffle (1951) noted that this dentine seemed soft during curettage, and Emslie, Riffle, and Stack (1956) have reported a 10 per cent reduction in the free amino-acid groupings of the outer cervical dentine of teeth extracted for periodontal disease when compared with teeth extracted for other reasons in a similar age group. The free amino-acid groupings represent only 1–2 per cent of the total organic content of the dentine, and the change demonstrated is extremely small. Nevertheless the figures were statistically significant, and it would seem to be an interesting finding in the light of the views of many clinicians that all cementum exposed in a pocket should be removed during scaling, and the dentine left smooth and hard.

There would, however, appear to be no good reason why any attempt should be made to remove the epithelial attachment during scaling when no reattachment procedure is contemplated. In fact, a minimum of damage to the soft tissues should be the aim.

To return to the "watch-spring" scaler: with this instrument it is possible to perform thorough subgingival scaling interdentally, with a minimum of damage to the soft tissues. One can commence with a push stroke which is well away from the bottom of the pocket, and then make each succeeding stroke at a slightly deeper level until no more calculus is felt. An oil stone should be at hand during scaling to keep the instrument sharp: the correct angle of the blade is obtained during sharpening when the handle is kept perpendicular to the oil stone. Tungsten-carbide push scalers of foreign manufacture are available, but are brittle and easily broken.

When the roots of teeth are close together, it may still be possible to push an actual watch-spring between them. A short piece is fitted into a broach-holder and sharpened to the correct cutting angle with a sandpaper disk. The small amount of space occupied by this blade is demonstrated in *Fig.* 10. The supply problem should present no difficulty—any watch repairer will be only too pleased to unload his broken watch-springs.

The size of a large spoon excavator in relation to the gingival tissues is shown in *Fig.* 11. It cannot be used interdentally as in the diagram, but on the labial and lingual

aspects of the teeth can be a most effective scaler, provided that the pocket is not too deep. Its advantage over a hoe scaler is that it can readily be introduced to the bottom of a shallow tight pocket. With the spoon at an angle of approximately 45° to the root the calculus is removed by a pull stroke. A contra-angle in the shaft is better for vision, but the spoon should be in the long axis of the handle to prevent turning of the instrument in the hand.

With shallow pockets the regions of the tooth which have been missed by the spoon excavator and watch-spring scaler can be reached by the Jaquette- or Howe-type of pull scaler.

Deeper pockets may be scaled more effectively with a curette or hoe-type scaler. Dimensions of the blade of a Gracey-type curette are superimposed on the specimen in *Fig.* 12. These were designed as push-pull scalers, but can, of course, be used as spoons to curette soft tissue.

Cross has discussed the advantages of tungsten-carbide tips for hoe scalers which are now of much neater design. A file of the Hirschfeld type is still neater, however, and at least one manufacturer is endeavouring to make these with tungsten-carbide tips. The advantage of a three-bladed tungsten-carbide instrument over a hoe is that there is less risk of cutting deeply into the tooth. Disadvantages of a multi-bladed scaler are that it is not possible to remove the majority of the calculus with one stroke, and also that one's tactile acuity is reduced—it is more difficult to appreciate the physical properties of a substance being abraded by a file. There is, therefore, a greater risk that smoothed calculus may be left on the tooth. But it seems sensible to use files to smooth the tooth after single-bladed instruments have left an irregular surface, and also to ensure that scaling has extended right to the base of the pocket.

Another instrument tested recently is the Hawe Vibrator. This Swiss instrument is an engine handpiece which may be used with different attachments as an amalgam plugger or a scaler. The tips for scaling are hoe- or file-shaped, and these oscillate rapidly in the head of the handpiece with approximately 1 mm. travel. This should ensure the rapid removal of calculus, but in my own hands the handpiece seemed rather unwieldy for scaling. It is necessary to change the attachments to reach the different aspects of the teeth.

One of these instruments, and also a number of different scalers were available for inspection at the end of the meeting.

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A.R.P.A. INTERNATIONALE

René Jaccard Prize

THE A.R.P.A. Internationale has established a special fund for the purpose of giving a reward every two years for the best work in original research concerning periodontal diseases. This reward will be known as the René Jaccard Prize and will consist of a medal and a diploma.

The prize will be given for the first time during the 12th International Dental Congress in Rome on September 11, 1957, on which date the 25th Anniversary of A.R.P.A. will be celebrated.

Candidates for the prize should submit original scientific publications or reports of work performed between 1956 and 1957 concerning periodontal disease. The prize is open to all irrespective of membership of A.R.P.A.

Six copies of the publication or report should be sent by registered post, not later than May 1, 1957, to the President of the A.R.P.A. Internationale, Professor A. J. Held, Institut Universitari de Medicine Dentaire, 30, rue Lombard, Geneva, Switzerland. The decision of the judges will be made known by July 31, 1957, and the prize (or prizes) will be given at the ceremony of the 25th Anniversary of the foundation of A.R.P.A. Internationale.

SIMPLE MANDIBULAR DENTURES— A FUNCTIONAL SOLUTION

By **J. F. BATES**, B.D.S.

Department of Prosthetics, Turner Dental School, University of Manchester

IT has been a well-known fact for many years that mandibular partial dentures which are totally tissue-borne, and which have an acrylic resin lingual bar, have a destructive action on the soft and hard tissues which leads to the ultimate loss of the remaining teeth. The sinking of the denture due to rapid resorption of the bone beneath the saddles leads to stripping of the gingivæ from the teeth. A further complication is that the occlusal load is now totally borne by the natural teeth and this may also lead to over-loading of the periodontal structures and the ultimate loss of the teeth. If, as in the majority of cases, the remaining teeth are the six lower anteriors, the loss of occlusal support posteriorly leads to the transmission of the total masticatory load to the upper anterior teeth or to the alveolus where there is an opposing full upper denture. In either case bone destruction may result with either loss of teeth or production of a flabby upper anterior ridge.

A bilateral free-end saddle "gum stripping" denture also leaves complications when the remaining teeth have been extracted without the interseptal bone being trimmed. Usually one finds a series of sharp and uneven bony spicules in the anterior part of the lower ridge together with an unsatisfactory contour of the alveolus for full denture construction. The difficulties encountered in making a satisfactory full lower denture when the remaining six anterior teeth are eventually extracted has led to some practitioners advocating their extraction and the construction of a full, rather than a partial, denture. This implies that no satisfactory partial denture can be constructed for this type of case.

PARTIAL DENTURE DESIGN

Objectives of Design.—In designing a partial denture of any type, the following fundamental objectives must be borne in mind: (1) Preservation of the remaining natural teeth; (2) Masticatory efficiency; (3) Æsthetics; (4) Comfort.

De Van (1952) has rightly stressed the preservation of the natural teeth as of paramount importance in denture design, and although this may not apply in all cases, it applies more particularly to mandibular partial dentures than to maxillary ones. In the latter case the patient may demand æsthetics as of primary importance in design. It is the failure to incorporate the principles of preservation in the "gum stripping" denture which leads to its destructive action. It is essential therefore to seek an alternative design and whilst the ideal form would be a gold or cobalt-chromium alloy skeleton denture, the cost is such as to preclude the use of these metals for the majority of partial denture patients. It could be argued, however, that once inserted, their longer life would render a much more efficient service than a full lower denture. A further difficulty is that the cobalt-chromium alloy technique calls for a large initial capital outlay, and there will be few practices that can afford to carry out their own castings.

In seeking an inexpensive but efficient alternative to the cast metal appliance it is suggested that assembled skeletons from wrought stainless steel bars and wires can be so constructed as to offer an excellent prosthesis incorporating all the previous objectives. This concept is not new, but dentures of this type have not been popular and routine construction seldom undertaken. The reasons for failure may be due in a large measure to the patient, but there are other factors in design and construction which have also led to this type of denture not being accepted as the routine in partial denture construction. These factors are considered below:—

1. When the models are not surveyed there is a failure of the clasping units since

they are not alined in a single path of insertion, leading to distortion of the clasps or destruction of the periodontal membranes of the abutment teeth. Failure to block out unwanted undercuts and to relieve the gingivæ leads to the denture being cut empirically with a burr at the chairside in order to allow insertion.

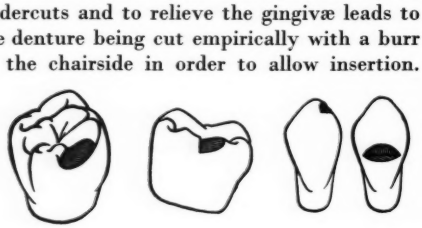

Fig. 1.—Diagrams to show the types of occlusal rest preparation in canines, a normal molar, and a tilted molar.

This naturally leads to a loss of fit with consequent damage to the soft tissues by stagnation and food impaction.

2. Failure often arises if a lingual bar is used without clasps to give positive retention, as many patients are unable to develop adequate muscular control.

3. Failure to incorporate occlusal rests leads to sinking and the masticatory load is again borne by the remaining natural teeth with resultant damage.

4. Inability on the part of the dental technician to bend the bars and wires accurately enough and without damage to the metal or to the plaster model. In this connexion it should be pointed out that the correct pliers are essential to this form of work just as in orthodontics and it is unlikely that results will be satisfactory unless the necessary apparatus is made available.

5. Failure to prevent movement of the wires and bars in the packing process.

General Principles of Design.—Partial denture saddles may be classified into two main groups; the first includes those which are entirely tooth supported, and the second group those which are totally tissue supported. It should be noted that in connexion with this second group, occlusal rests are, however, still utilized. In a bilateral free-end saddle denture, rests are incorporated to prevent the sinking of the appliance round the natural teeth, but only a little of the occlusal load will be distributed to the teeth.

Where possible, all dentures should be tooth supported, and in order to ensure that the masticatory forces are transmitted to the periodontal membrane in a favourable manner, the supporting teeth must be prepared by light grinding to form a smooth table at right angles to the axis of the tooth. In cases where the tooth is tilted, then, one must consider if the periodontal membrane is favourable for taking the occlusal load and if, as in most molar teeth, one can use it to support the denture, then the rest is prepared at right angles to the occlusal force. The position of the rest in this case may be moved to a more favourable position than adjacent to the saddle. *Fig.* 1 shows the position and type of rests in canines, molar teeth, and also in a tilted molar tooth.

Clasping units in the type of denture under discussion consist of an acrylic resin reciprocating arm and a flexible-wire retaining arm. The rest and clasping unit therefore comprise the ideal 3-arm unit (*Fig.* 2).

In cases where the periodontal condition of the teeth is such that supporting a denture may cause them to deteriorate even further, or in free-end saddle cases, the denture is constructed as a tissue-borne denture with the inclusion of some support to prevent sinking and destruction of the gingivæ. In such cases the occlusal rest and clasp are incorporated into one, so that the flexibility of the clasp reduces even further the load transmitted to the tooth by the occlusal rest with a consequent increase in the load borne by the tissues under the saddle.

DESIGNS FOR TYPICAL CASES

A Bilateral Free-end Saddle Design.—A case of this type, assuming the first premolars on each side are standing, may be designed with a lingual bar and a simple clasping unit on each premolar. Anterior rests are used to avoid damage to the periodontal membranes of the premolars.

If there is a tight contact point between $\frac{43}{34}$, a wire is bent from the lingual over the embrasure into the distobuccal undercut. If there is no contact point then the wire is bent to form a rest before going into a similar undercut. In such cases the flexibility of the wire

prevents the occlusal forces transmitting a great deal of load to the teeth, but prevents sinking of the denture. The acrylic arm on the lingual side is prepared as in *Fig.* 2. If æsthetics are important, the buccal clasp may be replaced by a Roach "C" bar approaching from the buccal flange, but a rest is still constructed.

Where only the six lower anteriors are present, little retention can be obtained from the teeth, and consequently the saddle must cover all the tissue possible and be so contoured as to promote muscular control. Occlusal support is obtained by an incisal hook over the mesial incisal surface of the canines and a

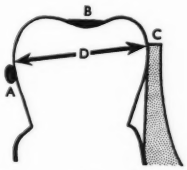

Fig. 2.—A diagram of the clasping unit for the partial dentures described. A, Retaining arm; B, Occlusal rest; C, Lingual plastic reciprocation in contact with tooth at or above the survey line D.

Roach clasp fitted buccally into any undercuts available or into the embrasure between the canine and lateral incisor.

A Design incorporating the Two Classes of Saddle.—In this type of denture there are two saddles, one of which is a unilateral free-end saddle, and the other a tooth-bounded saddle. The design for this type of case can be seen from *Fig.* 3.

Simple Anterior Saddle Designs.—This type of case is less frequent and presents difficulties in construction. For example, consider replacement of the four incisors; here the design shown in *Fig.* 4 may be employed. In this case there are two small retentive clasps as near the saddle as possible on the canines and a split crib applied to the first molars.

LABORATORY TECHNIQUE

As mentioned before, pliers are the most essential piece of laboratory equipment in this work. The three types which in our experience have proved most useful are shown in *Fig.* 5.

The construction of an assembled skeleton denture with a free-end saddle on one side and a tooth-supported saddle on the other may be used to demonstrate the stages in construction where they differ from standard procedures. The design may be seen in *Fig.* 3 and *Fig.* 6.

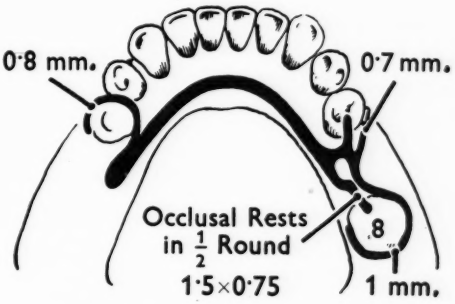

Fig. 3.—A diagram to show the design and size of stainless steel wires used in a denture with a tooth-tissue and a tooth-borne saddle.

The first procedure is to survey the stone model and block out all undercuts which are not required and to relieve the gingival margins where they are to be covered by acrylic resin. This is best accomplished by oxyphosphate cement or by plaster-of-Paris. A lead foil (from X-ray films) may be placed over the saddle area to act as a relief, whilst tin foil (gauge 10) is applied over the lingual surfaces of the teeth and tissues to prevent wear of the model. A strip of lead foil is bent to represent the lingual bar and when this is positioned satisfactorily it is removed and flattened and will give the necessary contour for the edge-bending of the lingual bar. Where preformed stainless steel bars are used, this stage may be eliminated and the bar fitted by as little bending as possible.*

The stainless steel wires are then bent and positioned. The case at this stage should be as in *Fig.* 3, which also shows the gauges of wires used (which are representative of all cases which are constructed).

At this stage one of two methods may be used. Either the bar and wires can be held together by cold cure resin or by soldering with pure tin. In the former case the lead foil

* Wipla bars have been found very satisfactory and are obtainable from Trudex of London.

is removed and the saddles coated in cold mould seal and the metal held in position with wax. The ends to be secured should be rough and separated to allow the resin to flow between. In soldering the metal is cleaned and "tinned" thoroughly and adapted so that a length of each wire component is in intimate contact, along its length, with the lingual bar. The metal is held in place by wax, compound, or plaster, but if the last is used, a separating medium is required which must be removed at a later stage. Wax tends to melt if the soldering is anything but instantaneous.

The soldering technique is similar to ordinary soft soldering so little need be said except to emphasize the need for cleanliness.

In the design for a single anterior saddle the posterior cribs are soldered and then "flushed" over with resin to give a smooth contour.

Fig. 4.—The skeleton design for a case with an anterior saddle only.

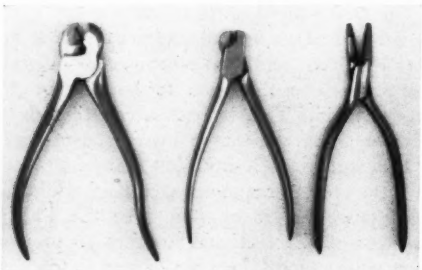

Fig. 5.—The types of pliers used. *Left*: A heavy duty bar bender (Sword Brand 5105). *Right*: Hollow—Chop of varying size. *Centre*: Aderer pliers (Sword Brand 5115).

The next stage which differs from the normal process takes place before flasking. The tin foil is removed and the metal which is to be exposed in the mouth is coated with either oxyphosphate cement or cold cure resin. In either case to get adequate adhesion of the material to the plaster it must be clean and consequently may need scraping. This method adequately prevents the movement of the clasps in subsequent procedures and has been found superior to the straightforward process of flasking where retention of the metal depends on the plaster covering. One advantage of the cold cure resin being used to hold the parts together rather than soldering is that it is in contact with the ridge and in packing there is less danger of the dough applying displacing forces to the metal parts.

Fig. 6.—The skeleton framework completed to the design in *Fig.* 3.

Processing should be carried out for at least 9 hours at 72° C. with a long cooling down, preferably in the water used for processing (Harman, 1949). On insertion it should be explained to the patient that the lingual reciprocation is liable to cause some loss of tissue tone unless adequate oral hygiene is carried out. (*See Fig.* 2.)

Acknowledgements.—I wish to thank Professor E. Matthews for his help and constructive advice, and Mr. B. Ellis for his invaluable technical assistance.

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THE APPLICATION OF 8-MM. CINÉPHOTOGRAPHY TO ORTHODONTICS*

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and **D. E. M. WARNER**, D.D.O. (Glas.), L.D.S. R.C.S.
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FEW will dispute the advantages of having cinéphotography available in a teaching department, particularly as an aid to instruction in practical technique. There is, however, a special interest in this type of record to the orthodontist, whose attention is being focused more and more upon behaviour and movement during function. In order to apply this medium for recording purposes it is necessary that it should be freely available within the department. It must, therefore, be simple to use and sufficiently inexpensive to allow for a certain amount of wastage; 8-mm. cinéphotography has both of these qualities. Its great depth of focus renders it relatively simple to use in the surgery. It is possible, with the aid of a moviola, to analyse the movements recorded on the film. It may, therefore, be used also as an instrument of research. When projected, the image can be enlarged to a width of 6 ft. The small frame size has, however, one disadvantage: separate frames are not satisfactory for reproduction without retouching.

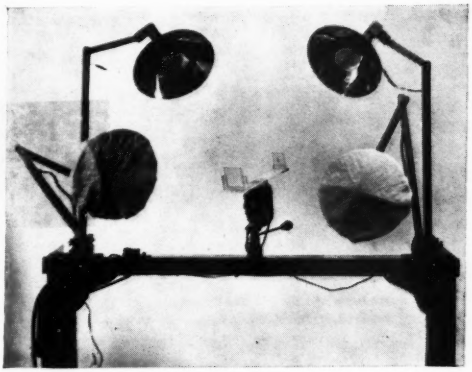

Fig. 1.—Camera and lighting mounted on table.

For clinical use the camera may be mounted on a movable table which can be set astride the chair (*Fig.* 1). Also mounted on the table are four adjustable lamp holders, with reflectors. In order not to subject the patient to prolonged incubation the lights may be dimmed while arranging the subject, by switching the lights over to a circuit in series. Because the distance of filming is small, a removable viewfinder has been fitted to the camera, for working at 1, 2, and 3 ft. (*Fig.* 2). When filming in black and white four standard 100-watt bulbs are used, whereas for colour film two 275-watt photoflood bulbs are used.

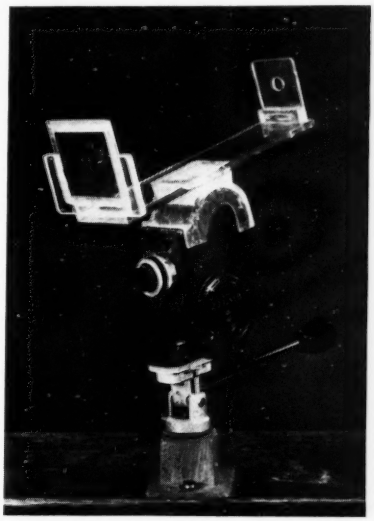

Fig. 2.—Perspex viewfinder with interchangeable frames for various distances, mounted on the camera.

* A demonstration shown at the Newcastle upon Tyne meeting of the British Society for the Study of Orthodontics, May 12, 1956.

The authors are greatly indebted to Mr. K. P. Liddelow, Reader in Prosthetics at King's College Hospital, for bringing the possibilities of this medium to their attention in the first place, and for continual help and advice subsequently; and to Dr. R. Cocker, Director of the Dental Department, for much encouragement.

MODIFICATIONS OF STANDARD ORTHODONTIC APPLIANCES*

By **J. R. E. MILLS**, M.Sc., F.D.S., D.Orth.

1. AN ATTACHMENT FOR EXTRA-ORAL ANCHORAGE

This attachment is in two parts; a hook on the fixed arch wire and a removable arm which passes round the angle of the mouth and which is attached by an elastic band to the head-cap or cervical anchorage.

The hook is shown in *Fig.* 1. It is made of 0·7-mm. hard stainless steel wire, and is soldered or welded to the arch wire, which

Fig. 1.

may be round, twin-wire, or edgewise. Care is necessary in attaching this hook to prevent softening of the wire by heat; it is important that the wire should remain rigid. It is in the shape of a letter L, with the vertical part about 2 mm. and the horizontal part 4 mm. long.

The arm is formed by soldering a piece of tubing, of internal diameter 0·8 mm., parallel to a piece of 1-mm. stainless steel wire, at its end. The tubing is then cut off, so that a piece about 5 mm. long is left attached to the end of the wire and parallel to it; at this stage it looks rather like a child's sky-rocket. The wire is bent gently back on itself, so as to pass around the angle of the mouth. A second band is made, at right angles to the first, to form a hook to take one end of the elastic band. This hook thus lies flat against the cheek. The finished attachment is shown in *Fig.* 2. The head-cap is worn nocturnally, and the arm

Fig. 2.

attached to the arch-wire by sliding the tubing over the horizontal part of the hook. This can be seen in *Fig.* 2, where the arm is on the hook but not quite "home". The attachment thus formed is rigid and transmits the pull of the elastic directly along the arch. At the same time the tubing can rotate about the hook, and this allows the arm to settle into the most comfortable position.

2. A MODIFIED LABIAL ARCH WIRE

The arch wire is a modification of the labial wire fitted on the well-known Hawley retainer, and shown diagrammatically in *Fig.* 3. This latter consists of a rigid wire fitting closely around the incisor teeth, with a loop at each

* A demonstration shown at the Newcastle upon Tyne meeting of the British Society for the Study of Orthodontics, May 12, 1956.

end for adjustment purposes. Its rigidity makes it an excellent retention appliance, but the lack of resilience makes it unsuitable for active tooth movement.

The resilience of the wire could be improved by increasing its length. This could only be achieved by making the "take-up" loops longer. If we extend them vertically we change the reflection of the mucosa, so we can only extend them mesially, as shown in *Fig.* 4. Unfortunately the wire then loses control of the canine and even, possibly, the lateral incisor.

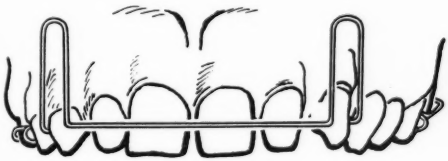

Fig. 3.

Fig. 4.

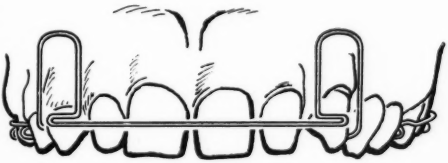

Fig. 5.

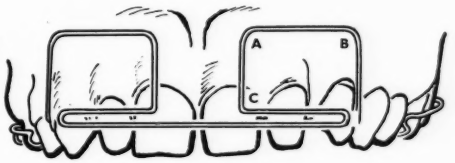

Fig. 6.

The solution to this problem is seen in *Fig.* 5. The labial wire is taken to the distal margin of the canine, and then bent back upon itself for a distance, before being bent at right angles, to form the usual adjustment loop. With this arrangement the canine is firmly controlled, and the size of the loops can be extended mesially until they almost meet in the middle, as shown in *Fig.* 6.

If constructed in 0·7-mm. stainless steel wire, this produces a labial arch wire of adequate resilience, which may be used for lingual movement of the upper incisor teeth or for alinement and rotation of teeth by "squeezing" the teeth against the acrylic on their lingual side. For either of these purposes the lingual acrylic must, of course, be trimmed away suitably.

Adjustment is effected by decreasing the radius of the curves A and B, thus closing the adjustment loops. This causes the distal ends of the wires to bend gingivally, which effect may be counteracted by opening the corner C.

The appliance forms an alternative to the "apron spring", which in my hands is simpler both to make and to use.

I wish to express my thanks to the Department of Medical Illustration, United Manchester Hospitals, for the illustrations.

Teeth, Streptococcus Viridans, and Subacute Bacterial Endocarditis

This disease is classified under two categories—category A, due to *Str. viridans*; and category B, due to other organisms. Category A is less severe, easily treated, prognosis is good, tendency to relapse is high, and the focus of infection is mostly teeth. Category B is more acute, presents therapeutic problems, has a less favourable prognosis, is unlikely to relapse, and the focus of infection is located in a site other than the teeth. In all patients who develop subacute bacterial endocarditis due to *Str. viridans* scrupulous complete dental clearance should be carried out as an essential item of the therapeutic attack upon the disease.—Hobson, F. G., and Juel-Jensen, B. E. (1956), *Brit. med. J.*, **2**, 1501.

LETTER TO THE EDITOR

Dear Sir,

Permit me to say how interested I was in Mr. Munro's paper on thumb-sucking, and the subsequent discussion report in the DENTAL PRACTITIONER, Nov., 1956. Perhaps, if your space permits, I might be able to throw some light on the very important question of the cause of this troublesome habit. In almost every case—but there are exceptions—thumb- or finger-sucking starts in the first few months of life, and stems directly from a disturbance or lack of satisfaction of the instinctive act of sucking on the infant's part. The question as to whether the infant is breast-fed or bottle-fed has little bearing on the problem, the secret lying in the proper balance between sucking time and sucking energy expended, and food intake. (A. G. H. Lawes, *Dent. J. Aust.*, 1950, **22**, Nos. 4, 5, and 6.)

Sometimes a sufficiency of milk is obtained in considerably less than the normal suckling time because of a very free flow of milk from the breast or a too open teat on the feeding bottle. When this happens nutrition requirement will be satisfied but the instinctive sucking act will remain unsatisfied. The infant will then seek for a substitute and will nearly always find it in the conveniently placed thumb. Once having discovered a substitute source of satisfaction it is, of course, all too easy to return to it again.

Yours faithfully,
ALLAN G. H. LAWES.

19A *St. John's Avenue,*
Gordon, N.S.W.,
Australia.

January 9, 1957.

DENTAL CARIES
Operative and Restorative Therapy

The following ten rules must be observed in operative and restorative therapy of dental caries:—

1. In any cavity, the peripheral zone of dentine bordering the enamel must be excavated down to hard dentine.

2. The margins of the cavity must be extended to sound enamel and also to the relatively caries-immune zones of the tooth surface.

3. The shape of the cavity must allow the insertion of a restoration which will not loosen or fracture, which will be subject to only minimal changes in form and to changes in volume in as close conformity with those of the tooth as obtainable.

4. The remaining tooth structure must be strong enough—if necessary supported by the restoration—to withstand the forces of mastication.

5. No more tooth structure should be sacrificed than is necessary to comply with the foregoing requirements.

6. All materials should be carefully selected; they should be used according to techniques that are based on the results of scientific investigations as well as on practical experience.

7. The marginal fit of the restoration should be such that no margins are discernible with a probe.

8. The filling must restore the tooth anatomically and functionally—if visible also æsthetically—to a harmonious part of the masticating apparatus.

9. Any trauma to the pulp and the parodentium, due to the preparation or the restoration, should be limited to the minimum.

10. The treatment should cause a minimum of discomfort to the patient.—DE BOER, J. G. (1956), *Int. Dent. J.*, **6**, 402.

BRITISH SOCIETY OF PERIODONTOLOGY

The Council of the British Society of Periodontology has decided that the cost of the Proceedings to non-members will be sixteen shillings a year.